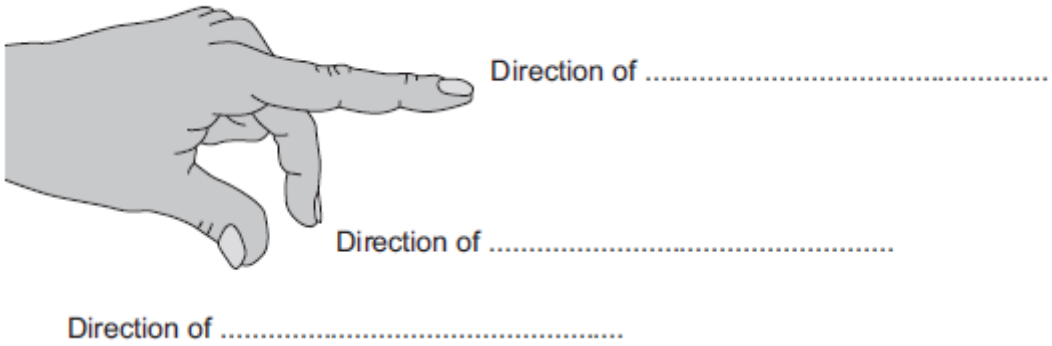
June 2015 Questions B

Q1. The left-hand rule can be used to identify the direction of the force acting on a current-carrying conductor in a magnetic field.

(a) Use words from the box to label **Figure 1**.

current	**field**	**force**	**potential difference**

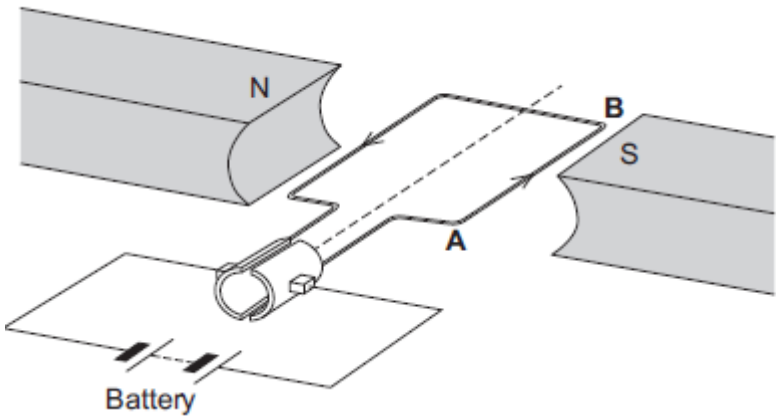
Figure 1



(3)

(b) **Figure 2** shows an electric motor.

Figure 2



(i) Draw an arrow on **Figure 2** to show the direction of the force acting on the wire **AB**.

(1)

(ii) Suggest **two** changes that would increase the force acting on the wire **AB**.

1.....

2.....

(2)

(iii) Suggest **two** changes that would reverse the direction of the force acting on the wire **AB**.

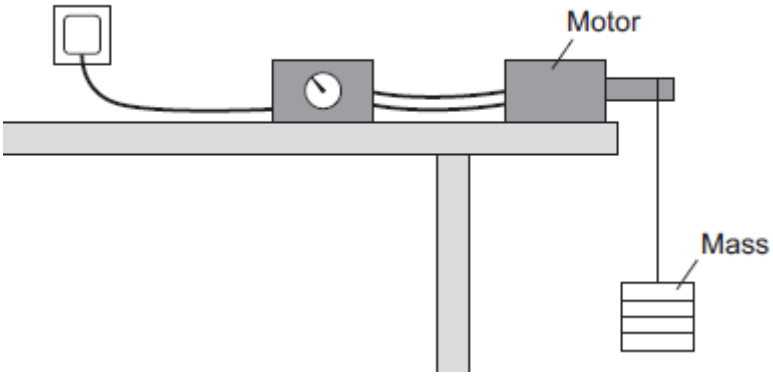
1.....

2.....

(2)

(c) A student used an electric motor to lift a mass. This is shown in **Figure 3**.

Figure 3



The student varied the electrical input power to the motor. For each different electrical input power, he recorded the time taken to lift the mass and calculated the output power of the motor.

The results are shown in the table.

Test	Electrical input power in watts	Work done lifting the mass in joules	Time taken to lift the mass in seconds	Output power in watts
A	20	24	2.4	10
B	40	24	1.2	20
C	60	24	0.8	30
D	80	24	0.2	120

The result for **Test D** is anomalous.

(i) Calculate the efficiency of the motor in **Test D**.

Use the correct equation from **Section C** of the Physics Equations Sheet.

.....

.....

Efficiency = ...

(2)

(ii) Comment on your answer to part (c)(i).

.....

.....

(1)

(iii) Suggest a reason for this anomalous result.

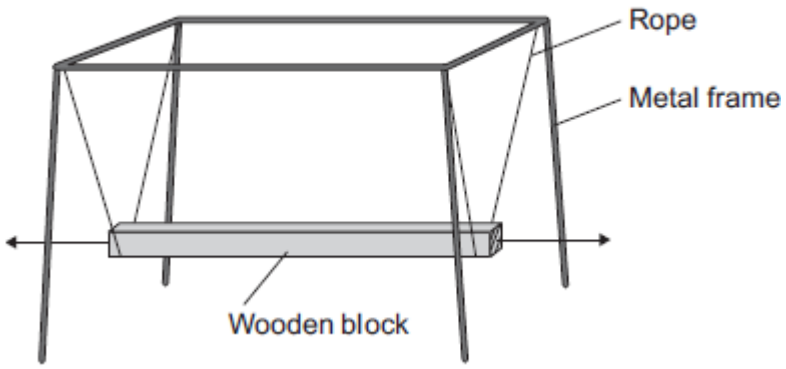
.....

.....

(1)
(Total 12 marks)

Q2.Figure 1 shows the design of a playground ride.

Figure 1



A large wooden block rests on ropes. The ropes are attached to a metal frame.

Children sit on the wooden block.

When the wooden block is moved to the left and released it moves to and fro.

When the wooden block returns to the point of release it has completed one cycle.

(a) Identify **two** possible hazards of the ride in **Figure 1**.

.....

.....

.....

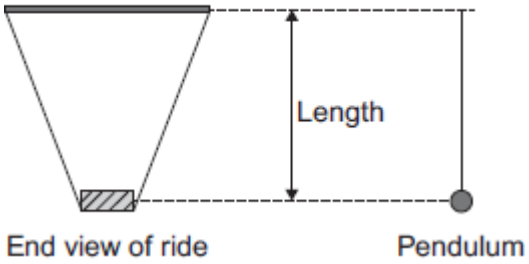
.....

(2)

(b) The designer of the ride wants to know if the ride has the same time period as a pendulum of the same length.

The designer used a model of the ride and a pendulum as shown in **Figure 2**.

Figure 2



The designer measured the time taken to complete 10 cycles for different lengths of both the model ride and the pendulum.

The results for the model ride are shown in **Table 1**.

Table 1

Length in metres	Time for 10 cycles in seconds				Mean time period in seconds
	First time	Second time	Third time	Mean	
0.100	6.36	6.37	6.29	6.34	0.63
0.150	7.76	7.74	7.80		
0.200	8.97	8.99	8.95	8.97	0.90

The results for the pendulum are shown in **Table 2**.

Table 2

Length in metres	Time for 10 cycles in seconds				Mean time period in seconds
	First time	Second time	Third time	Mean	
0.250	10.00	10.04	10.02	10.02	1.00
0.300	10.99	11.01	10.94	10.98	1.10
0.350	11.88	11.83	11.87	11.86	1.19

(i) Complete **Table 1**, giving values to an appropriate number of significant figures.

.....

.....

(3)

(ii) The investigation already includes repeated readings.

Suggest **one** improvement that could be made to this investigation.

.....

.....

(1)

(iii) The designer reads in an Advanced Physics textbook that:
'The square of the time period, *T*, for a simple pendulum is proportional to its length, *l*.'

$$T^2 \propto l$$

Would the model ride have the same time period as a simple pendulum of the same length?

Use **one** row of data from **Table 1** and **one** row of data from **Table 2** to work out your answer.

State your conclusion.

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.....

.....

(3)

(c) The ride was redesigned and built to make it safer.

The wood was moving at maximum speed. The maximum kinetic energy of the wood was 180 J.

A parent applied a force to the wood and stopped it in a distance of 0.25 m.

Calculate the force required.

Use the correct equation from the Physics Equations Sheet.

.....

.....

Force = ... N

(3)
(Total 12 marks)

June 2015 Answers B

M1.(a) field

correct order only

1

current

1

force

accept motion
accept thrust

1

(b) (i) arrow pointing vertically downwards

1

(ii) increase current / p.d.

accept voltage for p.d.

1

increase strength of magnetic field

accept move poles closer together

1

(iii) reverse (poles of) magnets

1

reverse battery / current

1

(c) (i) 1.5 or 150%

efficiency = 120 / 80 (× 100)
*gains **1** mark*
an answer of 1.5 % or 150
*gains **1** mark*

2

(ii) efficiency greater than 100%
or
output is greater than input
or
output should be 40 (W)

1

(iii) recorded time much shorter than actual time

accept timer started too late
accept timer stopped too soon

1

[12]

M2.(a) any **two** from:

- wood falls off ropes
- child falls off
- wood hits child standing at side.

accept any reasonable suggestion

2

(b) (i) 7.77

1

0.78

*0.777 or 0.77 gain **1** mark*

*their mean value / 10 gains **1** mark*

2

(ii) use longer lengths (so longer times)

or

do both with the same lengths (so comparison can be made)

timing more than 10 cycles is insufficient

1

(iii) **1** value of *k* from **table 1**

k values 3.969…

4.056…

4.05

$k = T^2 / l$

allow full credit for an equivalent correct method

eg. allow inverse of

$k = l / T^2 = 0.25$

1

1 value of *k* from **table 2**

k values 4

4.03…

4.046

allow if average time for 10 cycles used

1

conclusion that matches student's results

1

(c) 720 N

*180 = F × 0.25 gains **2** marks*

*work done = maximum kinetic energy gains **1** mark*

3

[12]